INFORMATION SYSTEMS FOR URBAN PLANNING

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INTRODUCTION

At the annual meetings of the American Society of Planning Officials in Seattle, I was struck with the predominance of certain words in the planner's vocabulary: long-range; coordinated; development; growth; renewal. Today, I suspect you will encounter, as these sessions proceed, another set of oft-repeated words: system; model; integration; simulation; interface. I shall focus on two of these words, system and integration. This will provide a brief, but useful, introduction to the two major subjects I want to present, which are first, approaches to urban information systems, and second, current efforts in this field that are underway around the country.

DEFINITIONS

I should like to apply definitions of the terms, system and integration to three areas: general, urban studies, and data systems.

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	System	Integration
In general (Webster):	"An assemblage of objects united by some form of regular inter-action or inter-dependence; an organic whole."	As a verb, integrate means "to indicate the whole of; to unify."
In urban studies:	Following the general definition, an urban system is an inter-dependent assemblage of people and property and activities between them. Although it is common to specify that systems must have goals, I am not sure it is a requisite in this context. If we do require a goal to be specified, it is clear that urban systems and their components have a multitude of goals that have hitherto defied systematic explanation.	Integration is a way of looking at the city, to search for "forms of regular inter-action or inter-dependence" that make cities some sort of organic whole. This definition is meaningful when contrasted to the alternative approach, which one might call "disintegrated," where the city is one kind of world to the social worker, and a much different kind of world to the police chief and urban planner.
In data systems:	An inter-related set of data items, procedures, people, and machines that are designed to serve a specified goal.	The unified handling of the same data to serve various purposes, e.g., putting the census tract number on a building permit application so analysis of building trends can be made by planners, assessors, fire departments, and urban renewal agencies. That this concept of integration is basic can be seen by the fact that carbon paper can be used to provide a form of data integration.

APPROACHES TO URBAN INFORMATION SYSTEMS

To provide a basis for debate, let me delineate two alternative approaches to the development of urban information systems. In this

delineation, I shall stress distinctions between the two approaches more sharply than common sense or practice actually will support.

Approach A: The "information availability" approach, whose purpose is to design a system that will handle a wide range of information, large independent of the uses to which the information is put.

Approach B: The "information requirements" approach, whose objective is to design a system to handle only that information required for specific decisions and operations which have themselves been analyzed in considerable detail.

Because I shall advocate Approach A, let me describe Approach B so that you can see the contrast. The information requirements approach puts major emphasis on determining what data are really important to specific decisions and operations. For example, what data are needed for police manpower assignment, budget allocation, or zoning decisions. In this approach, an effort is made to determine the "optimum" set of data for such decisions by analytical methods. This is a gigantic task (and an important one) and it is necessary that this approach be used in specific instances. However, it seems to me that planners should give higher priority to Approach A, since it promises bigger payoffs for urban information systems in both the short and the long run.

The information availability approach simply means building a data system to integrate the collection and storage of data and to

make them readily accessible without worrying a great deal about what the user does with them. Our conclusion favoring this approach results from two years of research conducted at The RAND Corporation on data processing for state and local governments.

Data Processing for State and Local Governments

Several key words express the flavor of our research -- inter-governmental, in that we dealt with the entire complex of functions performed by states, counties, cities, townships, and districts rather than with the particular operations of any specific agency. Conceptual, in that we tried to think big and fresh, in terms unconstrained by the organizational and procedural problems that frequently dominate the design of data systems. Futuristic, in that we focused on the 1970-75 period both as to foreseeable EDP equipment capabilities, and as to trends in governmental characteristics that affect data systems.

We based our approach on a conviction that advancing data processing hardware capability makes new concepts of information handling both feasible and desirable. This hardware capability and the data systems which it serves can be examined in terms of five activities: input, output, storage, processing, and communications.

Hardware Capability

In brief summary, here is the capability we believe EDP equipment will provide by the end of this decade. Input: reliable optical reading of many type fonts and handprinted characters, as well as refinements in existing media and techniques such as reading of

various forms bearing marks or holes in prespecified spaces. Output: increasing speed and versatility in printed output together with greatly increased ability to display information in visual images, as well as alphanumeric characters. Storage: electronic files that will hold billions of data characters with access to any set of characters measured in seconds. Processing: multiple programs running essentially simultaneously on equipment operating at cycle speeds measured in billionths of a second. Communications: reliable transmission rates over the common carrier message network measured in hundreds of characters per second; leased line capacities many times greater.

Within these capabilities, there will be considerably greater flexibility and variety in specific devices and techniques. Costs per unit of work will diminish sharply, especially in storage and communications. We believe that mass volume, rapid access storage, coupled with expanded communications capability, will increase the attractiveness of the remote input/output-centralized processing/storage concept. This will enable many organizations, especially small ones which cannot afford a complete set of data processing equipment, to acquire input/output devices and "hook in" to a system which will give them access to large capacity processing and storage equipment. In sum, the technological capability of data processing equipment a few years hence will be enormous and invites the development of new system concepts that fully exploit it to support urban information handling requirements.

State and Local Government Characteristics

Because data systems serve organizations, they must be designed to fit organizational characteristics and requirements. Trends in state and local governments that affect data systems seem clearly to indicate increasing inter-dependencies and inter-relationships among agencies. Diversity in size, function, and organizational structure will undoubtedly continue, but an increasing recognition will emerge that public problems, and especially data needed to solve these problems, frequently transcend jurisdictional boundaries. As urban populations grow, the autonomy of local agencies will gradually diminish, especially in metropolitan areas.

Population and services will expand; so will data processing workload. To support decisions of growing complexity, administrators will increasingly require systems that supply more and better data and enable these data to be manipulated in more sophisticated ways, such as through the techniques of operations research. Increasing awareness that urban problems require integrated solutions will lead to recognition that such solutions require integrated data systems.

Given the capability of data processing technology and the nature of state and local governments, we then examined the nature of the data these agencies handle in performing their functions. Conventionally, state and local governments have organized their information systems around the uses to which the data are put. Hence, we have police data, welfare data, accounting data, education data, employment data, etc. What has resulted from this practice? (1) There is extensive duplicate collection and storage of the same information items;

(2) information collected by one function for its own uses is often unknown to other functions which could use this information, if they were aware of its availability, and if it were in a form usable to them; (3) because of jurisdictional, mechanical or procedural problems, information items are not efficiently shared among functions and agencies; (4) there is often complete absence from any file of certain data useful to one department, which could easily be gathered in the normal operations of another, if the need for the data were known.

In an effort to reduce these problems, we have carefully examined the data within each such functional category and have concluded that while the data are used for many different purposes or functions, the data themselves are surprisingly often the same. This similarity is revealed in the answer to the question: "What basically do these data describe?" Approached from the answer to this question, state and local government data can be organized in two classifications -- neither related to the functional departments that use the data, but together including all the data used by these agencies. The first class contains data describing the environment in which these governments operate and for which they have some responsibility. The second class contains data relating to the internal operations of the governmental agencies themselves.

The environment in which state and local governments operate is composed of three categories of objects: real property, persons, and personal property. This environment is common to many agencies of state and local government, i.e., a parcel of land or a person falls

within the purview of different agencies for different purposes. For example, the same parcel of real property may be taxed by a county, zoned by a city, and provided with fire protection by a special district. Similarly, a person may be licensed to drive by the state, registered to vote by a county, and provided with welfare aid by a city. Usually, several functional departments of the same governmental unit provide different services to the same persons or parcels. The significant characteristic of the state and local government environment, therefore, is that it is common to many functions and agencies.

Because these agencies direct their functions at persons and property, all environmental data they use describe persons and property and the events in which these objects have been involved. We have therefore organized environmental data according to the objects they describe rather than according to their functional use. Instead of analyzing welfare data, for example, we have identified those data about persons that are used to perform the welfare function. From this approach we have assembled a comprehensive group of specific data items describing persons and property which are used to carry out state and local government functions.

Internal data, as distinct from environmental, relate to the internal operations of the agencies themselves. These data describe the resources an agency has to perform its functions and the activities in which these resources are used. The resources are dollars, employees, equipment, and facilities, and most data in the internal category are used to account for these resources in various ways. Because each agency has its own resources and carries on its own activities, data

in the internal category are generally limited in interest to the single agency concerned. Environmental data, on the other hand, because they describe an environment common to many agencies of state and local government, are frequently of multiple interest. Our focus has therefore been on the development of a system to handle environmental data.

Unified Information System

Based on the three elements of technological capability, organizational trends, and data characteristics, we have outlined a Unified Information System as a long-range data system goal for state and local governments. Each of these words is significant. System means that environmental data used by states, counties, townships, cities, and special districts are connected by specified procedures that are cooperative and comprehensive. Information restricts the objectives and operations of this system to items of data alone. No changes in the functions, basic organizational structure, or management responsibilities of state and local governments are involved. Unified describes the grouping of the data and the blend of data processing activities into a combination of centralization and decentralization which is appropriate to the organization and functions of state and local governments.

The Unified Information System is designed for the 1970's and has two major objectives: (1) to reduce duplication in the collection, storage, and processing of data used by state and local governments, and (2) to increase the accessibility and usefulness of these data.

In essence, the Unified Information System provides an Information Center to store and process data gathered and used by state and

local governments within a particular state. The System is designed primarily to enable environmental data to be efficiently organized into records about the persons and parcels of property they describe. Data gathered in the regular operations of governmental agencies would be transmitted to the Information Center via communications channels, often the conventional telephone network. Similarly, agencies could obtain from the Center either raw or processed data for use in performing their functions. The System does not require the collection of any new data and is entirely independent of the purposes or procedures for which the data are used. It simply provides a technological facility to file these data and to process them according to the instructions of participating agencies.

The Information Center would consist of computers and associated devices together with personnel to program and operate the equipment. There could be more than one Center location within a single state, though the System is statewide, and different Center locations would be linked by communications lines to function logically as a single Center. Such a Center could be a public agency created by the collective action of state and local governments, and responsible to them. It could be supported financially by charges for services rendered.

Data within the Center files would be organized into records describing individual persons and individual parcels of real property.*

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*Data about articles of personal property are generally either of limited interest or, as in the case of motor vehicles, already maintained in statewide, central files.

A separate street section file would be maintained for data describing defined public rights-of-way.

Our research indicates file size on the order of a quarter billion to five billion characters depending on the extent of data coding and the number of persons and parcels in the state. The primary criterion for placing data within the System files would be that a particular item of information is of interest to some agency other than the one which originally collects it. In addition to such "common" data, agencies would often find it preferable to store certain items of interest only to themselves, i.e., "specialized" data, in Center files, rather than set up separate files for these data. For example, placing one or two items of specialized interest to civil defense agencies in the Center's property parcel file would generally be preferable to maintaining a separate civil defense data system, since the majority of parcel items of interest for civil defense purposes is also of common interest for other purposes.

In addition to providing central parcel and person records, the Information Center facility could be used by agencies for any mechanized data handling, and many agencies would undoubtedly choose to use Center facilities for <u>all</u> mechanized data handling in preference to operating their own complete set of data processing hardware. Under the Unified Information System, participating agencies would need to acquire only input and output devices since the processing and storage of information could be handled centrally by the Information Center.

The Information Center is more than the familiar data bank concept in that it not only stores data and supplies them in a raw form to using agencies, but also processes data for use in the <u>regular</u> operations of state and local governments. For example, we would envision

the Information Center preparing precinct lists, issuing driver licenses, making extensive land use analyses, and monitoring data for management control and statistical reporting. All of these functions would be carried out exactly in accordance with the instructions of participating agencies; the Center would perform only the information processing involved.

In such a system, the documents on which data are originally recorded would remain with the participating agencies; only data from these documents would be transmitted to the Information Center. A great variety of input devices and methods could be used by participating agencies to enter data into the System. Optical reading devices are promising, but punch cards, both key punched from source documents and used as source documents themselves, will surely continue. The System does not require standardization of input media or output format between agencies. Neither does it require statewide standardization of data. The data definition problem can be solved by establishing equivalencies between a standardized meaning acceptable to all System participants and the local meaning of each participating agency. In many cases these would be the same, but if, for example, a city wished to have a more sophisticated land use categorization scheme than the statewide standard, the System would simply involve establishing equivalencies between local and standard data definitions. Computers can make the equivalency exchange and supply data according to either definition in response to the user's request.

While the system concept we recommend as a long-range goal is based on a statewide geographic jurisdiction, we believe regional

systems and agency systems embodying the person and parcel central record concept are appropriate transition steps.*

Having outlined the results of our research, let me briefly compare the alternative approaches A, availability, and B, requirements. We favor Approach A, first, because data are being collected, and will continue to be collected, by many agencies for many purposes. Organizing these data into a unified system produces direct economies as well as improved information availability. Second, Approach A provides data to enable the sensitivity testing necessary to permit designation of the "optimum" sets of data for specified decisions which Approach B requires. Third, decision data requirements are difficult to make explicit to everyone's satisfaction, and managers are going to require that a wide range of data be provided to them for a number of reasons, including their traditional availability, entirely apart from what analysts say are "the" relevant data. Fourth, new and unforeseen decisions require unforeseen data. Such decisions will continually arise, and therefore urban information systems should be designed to handle a wide range of data items rather than only those items which we are able to specify a need for today. EDP technology is decreasing the unit costs of massive information handling so such a concept need not entail overwhelming expense.

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*For further description, see Edward F. R. Hearle "A Data Processing System for State and Local Governments," Public Administration Review, Sept. 1962, pp. 146-152; Edward F. R. Hearle and Raymond J. Mason Data Processing for Cities, Management Information Service Report 219, International City Managers Association, April 1962; and idem, A Data Processing System for State and Local Governments, Prentice-Hall, Englewood Cliff, New Jersey, 1963 (in press).

In concluding this discussion of approaches to urban information systems, let me stress that, while convinced the approach I have advocated is the preferred one, I do not want to be dogmatic. The study of urban information systems is in earliest infancy, and we should all maintain a large measure of caution about having discovered "Truth." Let me therefore put aside the role of an advocate, and turn to a description of current efforts underway around the country.

CURRENT URBAN INFORMATION SYSTEM EFFORTS

Current urban information system efforts are at different stages of development, and in different degrees of sophistication, but they all endeavor in one way or another to provide better data to manage the affairs of urban areas. The efforts described here are by no means all those underway, but they are a useful cross-section of areas, cities, and types of programs. All of them stress continuing rather than "single survey" data systems.

El Paso, Texas has developed a punch-card system and reported it in Technical Report 62-1, A Data Storage System for Land Use Analysis, April, 1962.

Dade County, Florida has engaged in a data collection program, the methods for which are described in Methods Manual, Land Use Study for Metropolitan Dade County, Florida, Metropolitan Dade County Planning Department, January, 1961.

Philadelphia, Pennsylvania has been working on the development of a parcel file for several years. This is reported in Harlin G. Loomer, "Land Use Inventory in Philadelphia," Papers Presented at the Census Tract Conference, December 29, 1958, Bureau of the Census,

Washington D. C., 1959. The Penn-Jersey Transportation Study has examined the regional data problem, and PENJERDEL has commissioned a study by the Wharton School concerning an area data service.

Pittsburgh, Pennsylvania is developing a parcel record system on magnetic tape and is doing pioneering work to develop an urban renewal simulation model for examining urban renewal problems within the city.

Providence, Rhode Island has had a punch-card system concerning land use for several years.

Baltimore, Maryland is exploring the establishment of a regional data system.

Detroit, Michigan is putting parcel records for land use analysis on magnetic tape.

San Diego, California has had a parcel system in effect for several years, and Santa Clara County, California has recently installed a similar system on magnetic tape equipment.

The San Francisco Bay area, under auspices of the Association of Bay Area Governments, is beginning to explore the possibility of an area data system, and the Washington D.C. metropolitan area, under auspices of the Metropolitan Washington Council of Governments, is nearly ready to launch a similar study concerning that region.

Portland, Oregon is exploring a parcel file, and the states of Connecticut, Hawaii, and New Jersey are all in the early stages of looking into statewide data systems to serve planning purposes.

Most of you are familiar with the efforts underway in Los Angeles and Spokane, and we will learn more about these during this conference.

Finally, I should like to report in a bit more detail the efforts underway in the "Metropolitan Data Center Project," involving the cities of Denver, Fort Worth, Little Rock, Tulsa, and Wichita. This project is partially supported by the demonstration grant program of the Urban Renewal Administration, and is developing a parcel record containing 80 to 90 items of data concerning parcels within the jurisdictions of the planning commissions in these areas. These records will be on magnetic tape, and computer programs are being written to bring data into the files, to retrieve them from the files, and to supply them in a variety of formats to using agencies. The focus in identifying data requirements has been "planning and urban renewal activities" with data being supplied by many local agencies and departments. The project budget is $288,000, of which $192,000 is from the Federal Government, and the remainder provided as services by the participating agencies. This project was initiated in 1960, formally authorized in 1961, and is now well underway with a target date for pilot system operations in early 1964. These dates are indicative of the time required to take a project from initial conception to implementation and operations.

CONCLUSION

In summary, I have presented (1) definitions of the words system and integration that are central to any discussion of "information programs for urban planning;" (2) alternative approaches to urban information system design, the "availability approach," and the "requirements approach;" (3) a description of some research which has led us to conclude that the availability approach is the preferable one;

(4) a report of some efforts underway around the country.

May I leave you with two thoughts:

First, a feasible and desirable program for you to embark on now is to organize the data collected by many departments and agencies concerning real property into central parcel records. Whose jurisdiction the systems and data processing equipment fall into is an interesting and important question, but one that may be less difficult to answer once agreement on the concept is achieved. Planners are in a strategic position to lead in the conception and formulation of such comprehensive urban data systems because they are major consumers of information and recognize its value. True, they do not generate many of the data they need, but the very comprehensiveness of their data requirements gives urban planners good reason to take the leadership in developing comprehensive systems that would serve not only city planning, but many of the other functions of local government as well.

Second, do not expect urban data systems to be developed and implemented quickly. In Philadelphia, the PENJERDEL study has been examining the problem for two years and is still seeking to resolve some questions. The Metropolitan Data Center will be four years from conception to pilot operation. Here in Los Angeles, the initial report by Stanford Optner, The Feasibility of Electronic Data Processing in City Planning, is dated January, 1959, and it was not until January, 1963, that a pilot system, implementing some of these ideas, was in operation. This is not to say that performance in these agencies has been poor; on the contrary, good people have been involved, and there has been a real desire to do significant work. Data

system design, when it endeavors to serve comprehensive objectives, simply cannot be done quickly, and even if the time above is cut in half, we can see that miracles should not be expected.

As a final word, may I stress that planners occupy a strategic position in the effort of local governments to develop improved data systems. You have a broad perspective and intense interest in the total impact of government policy on urban growth. Information systems are a natural tool for furthering your worthwhile objectives. I urge you to keep the words system and integration in the forefront of your thinking as you embark on programs to develop better information systems to help forge a better urban environment.